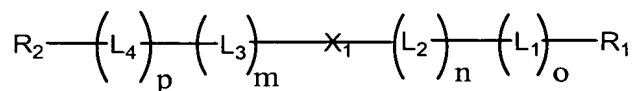


We claim:

1. An oligonucleotide prodrug of the formula (I):



(I)

wherein:

$R_1$  and  $R_2$  are independently H or a polymer residue;

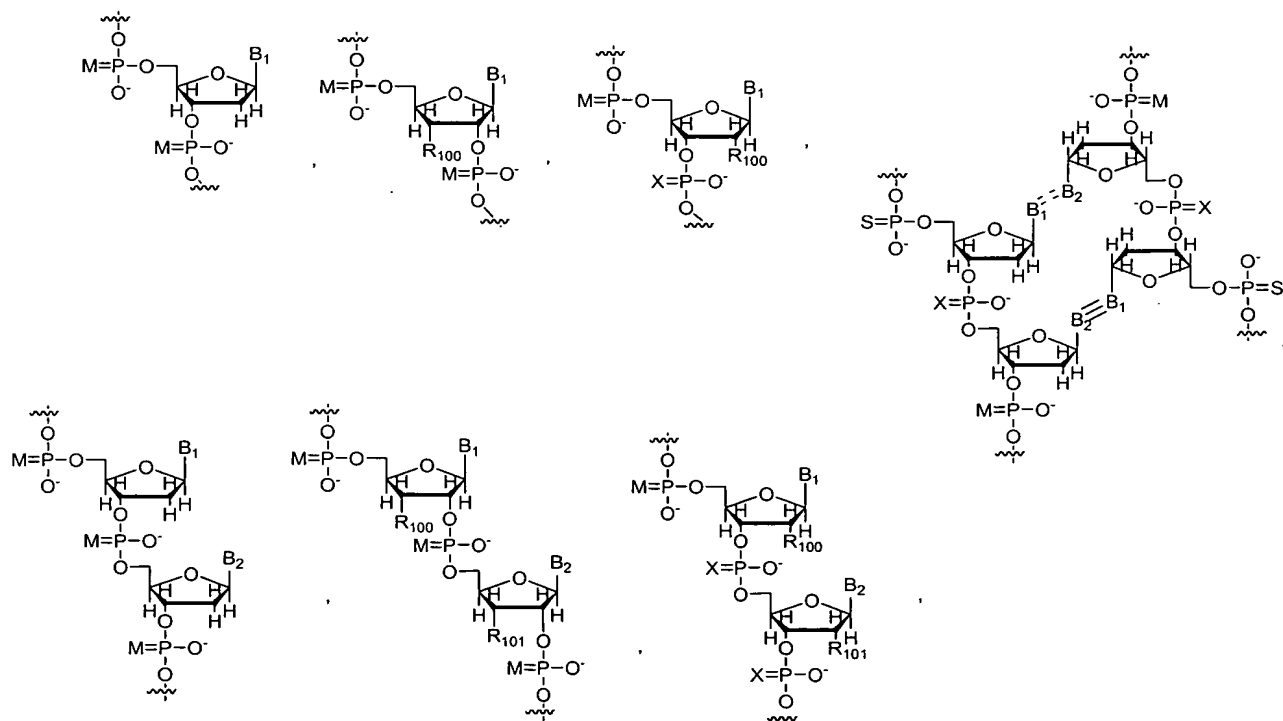
$L_1$  and  $L_4$  are independently selected releasable linking moieties;

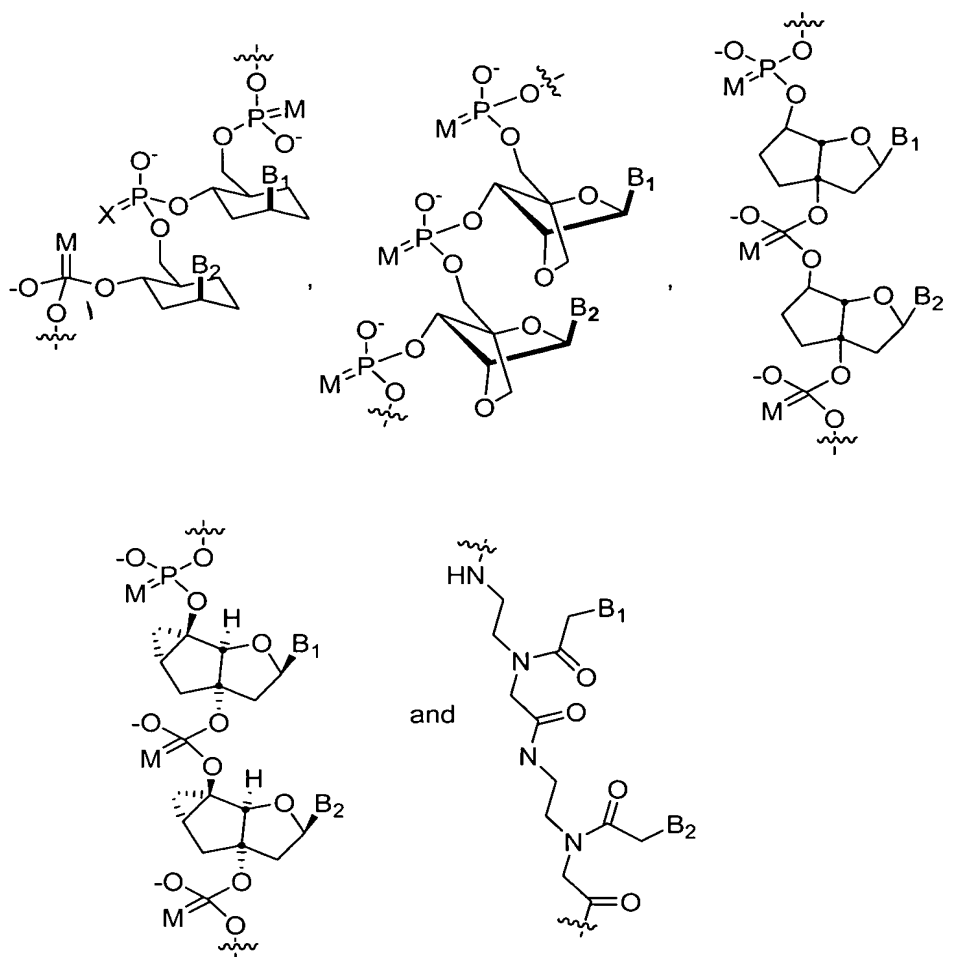
$L_2$  and  $L_3$  are independently selected spacing groups;

$X_1$  is a nucleotide or an oligonucleotide residue;

$m$ ,  $n$ ,  $o$  and  $p$  are independently zero or a positive integer, provided that either  $(o + n)$  or  $(p + m) \geq 2$ .

2. The prodrug of claim 1, wherein said nucleotide is selected from the group consisting of





wherein

M is O or S;

- 5        B<sub>1</sub> and B<sub>2</sub> are independently selected from the group consisting of A (adenine), G (guanine), C (cytosine), T (thymine), U (uracil) and modified bases;  
       R<sub>100</sub> and R<sub>101</sub> are independently selected from the group consisting of H, OR' where R' is H, a C<sub>1-6</sub> alkyl, substituted alkyls, nitro, halo and aryl

- 10    3.        The prodrug of claim 1, wherein said oligonucleotide is contains from about 10 to about 1000 nucleotides.
4.        The prodrug of claim 1, wherein M is S.

5. The prodrug of claim 1, wherein the oligonucleotide is a phosphorothioate oligonucleotide.

6. The prodrug of claim 1, wherein said oligonucleotide residue is an antisense oligonucleotide residue or oligodeoxynucleotide residue.

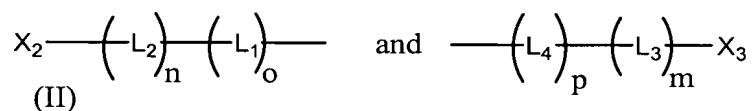
7. The prodrug of claim 6, wherein said antisense oligonucleotide residue or oligodeoxynucleotide residue is selected from the group consisting of, oligonucleotides and oligodeoxynucleotides with phosphodiester backbones or phosphorothioate backbones, LNA, PNA, tricyclo-DNA, decoy ODN, RNAi, ribozymes, spiegelmers, and CpG oligomers.

10

8. The prodrug of claim 6, wherein said antisense oligonucleotide has a sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO: 2, SEQ ID NO: 3, and SEQ ID NO: 4, wherein X of SEQ ID NO: 4 is any compatible nucleotide.

15

9. The prodrug of claim 1, wherein at least one of R<sub>1</sub> and R<sub>2</sub> is a polymeric residue having a capping group A, selected from the group consisting of OH, NH<sub>2</sub>, SH, CO<sub>2</sub>H, C<sub>1-6</sub> alkyls,



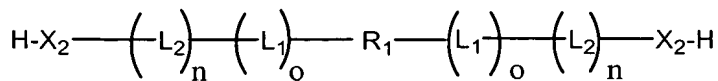
(II)

(III)

20

wherein X<sub>2</sub> and X<sub>3</sub> are independently selected nucleotide or oligonucleotide residues.

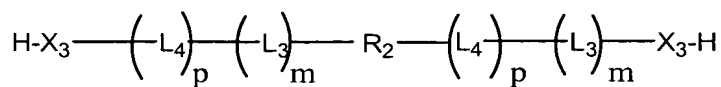
10. A prodrug of claim 9, selected from the group consisting of:



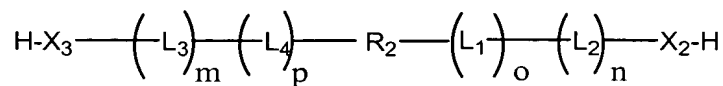
(i)

bis-3'-oligonucleotide,

25

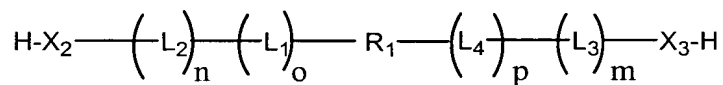


(ii)  
bis-5'-oligonucleotide,



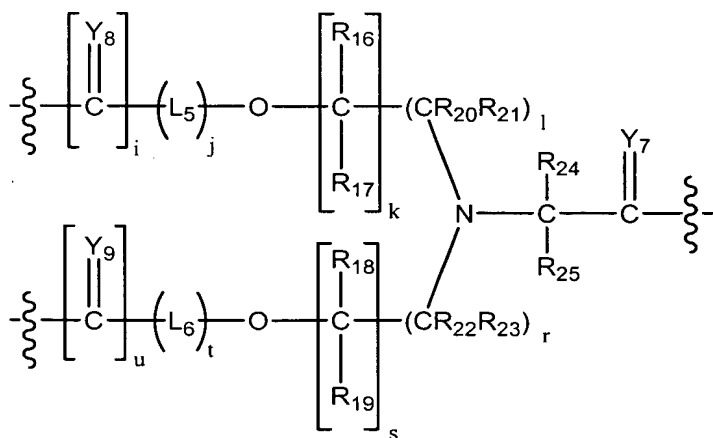
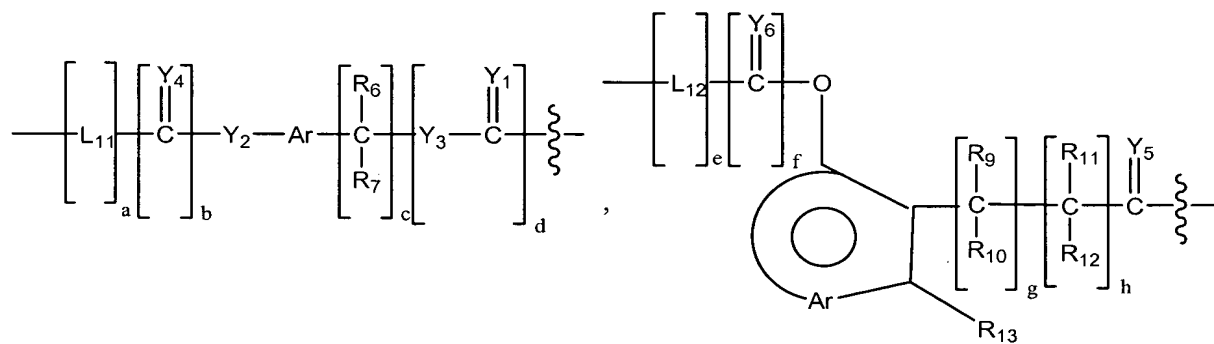
(iii)  
bis-5', 3'-oligonucleotide,

and



(iv)  
bis-3', 5'-oligonucleotide.

11. The prodrug of claim 1 wherein  $\text{L}_4$  is selected from the group consisting of:





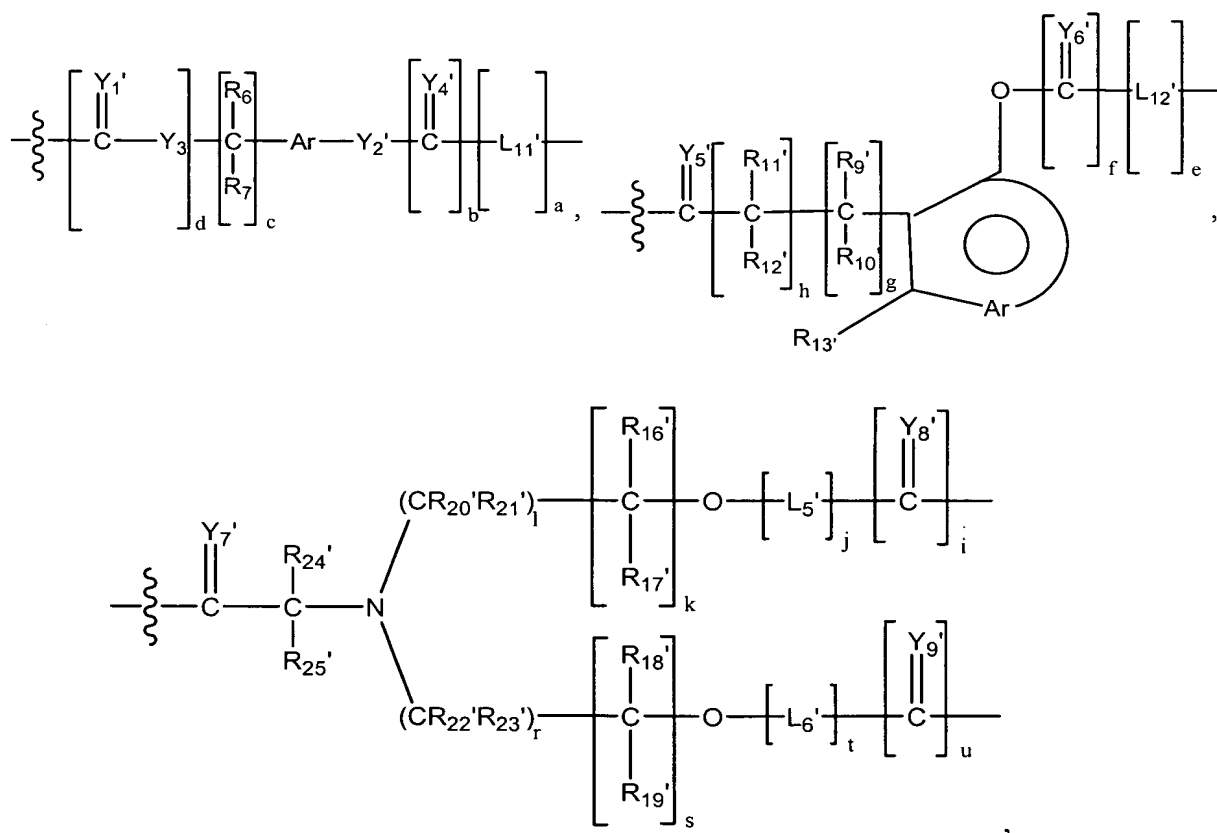
Z is selected from among moieties actively transported into a target cell, hydrophobic moieties, bifunctional linking moieties and combinations thereof;

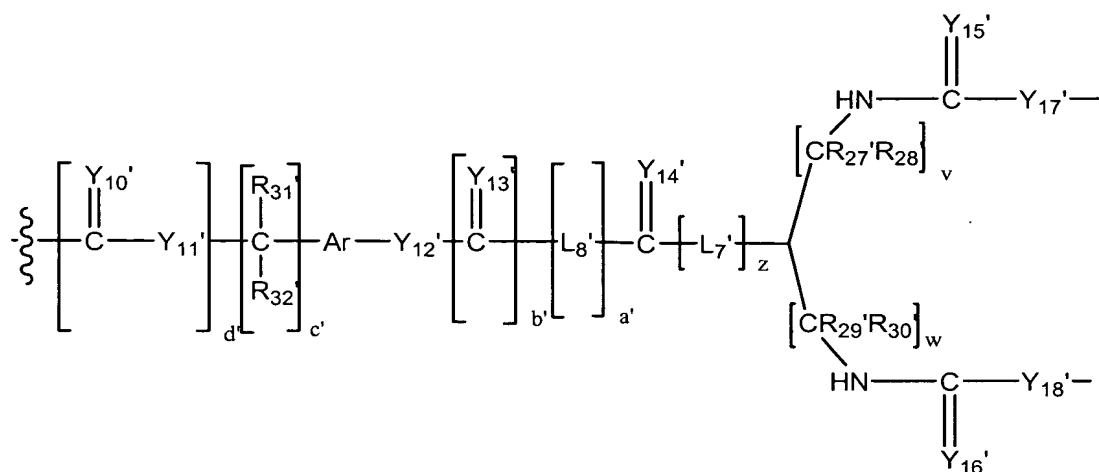
c, h, k, l, r, s, v, w, v', w', c', and h' are independently selected positive integers;

a, e, g, j, t, z, a', z', e' and g' are independently either zero or a positive integer; and

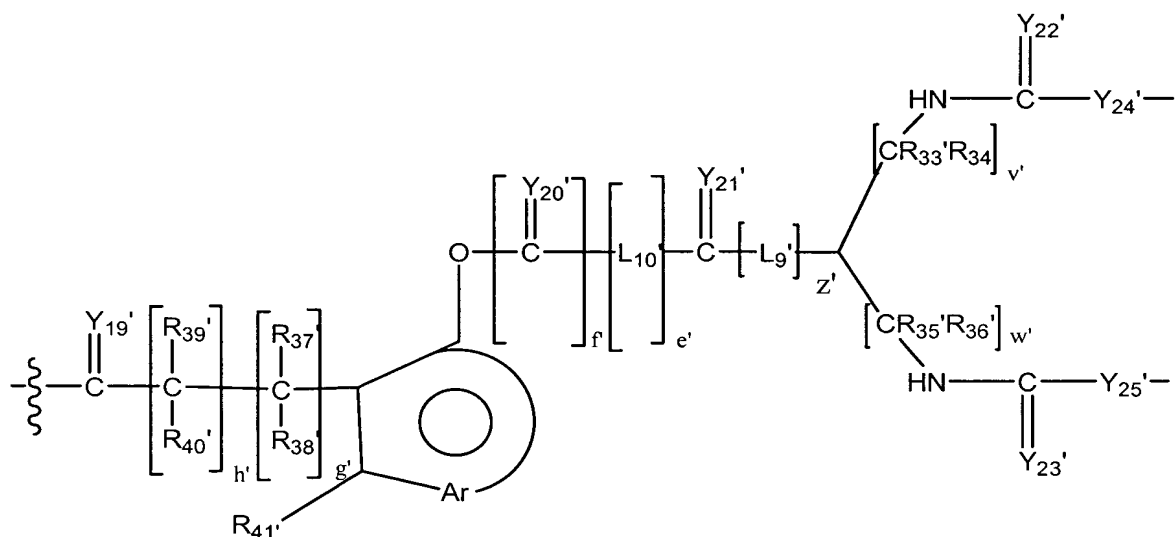
b, d, f, i, u, q, b', d' and f' are independently zero or one.

10 12. The prodrug of claim 1 wherein L<sub>1</sub> is selected from the group consisting of:





and



5 wherein,

$Y_{11}'$ ,  $Y_{25}'$  are independently selected from the group consisting of O, S or  $NR_9$ ;

$R_{6}'$ - $R_{7}'$ ,  $R_{9}'$ - $R_{13}'$ ,  $R_{16}'$ - $R_{25}'$ , and  $R_{27}'$ - $R_{41}'$  are independently selected from the group consisting of hydrogen,  $C_{1-6}$  alkyls,  $C_{3-12}$  branched alkyls,  $C_{3-8}$  cycloalkyls,

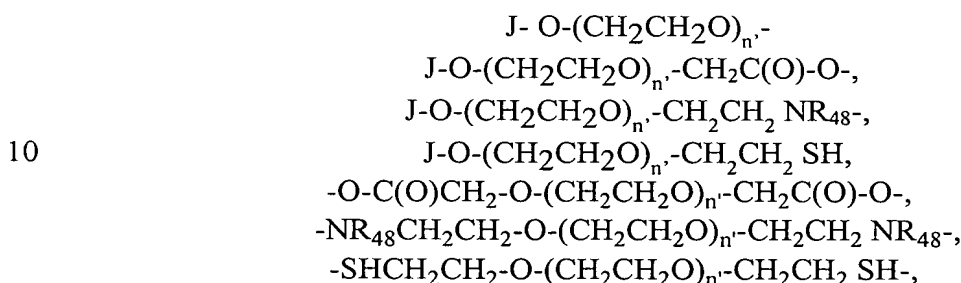
10  $C_{1-6}$  substituted alkyls,  $C_{3-8}$  substituted cycloalkyls, aryls, substituted aryls, aralkyls,  $C_{1-6}$  heteroalkyls, substituted  $C_{1-6}$  heteroalkyls,  $C_{1-6}$  alkoxy, phenoxy and  $C_{1-6}$  heteroalkoxy; and

$L_{5}'$ - $L_{12}'$  are independently selected bifunctional spacers.

13. The prodrug of claim 1 wherein  $R_{1-2}$  are each polyalkylene oxides.

14. The prodrug of claim 1 wherein  $R_{1-2}$  are each polyethylene glycols.

5 15. The prodrug of claim 1 wherein  $R_{1-2}$  are independently selected from the group consisting of:



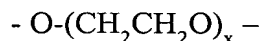
wherein

$n'$  is the degree of polymerization;

15  $R_{48}$  is selected from the group consisting of hydrogen,  $C_{1-6}$  alkyls,  $C_{3-12}$  branched alkyls,  $C_{3-8}$  cycloalkyls,  $C_{1-6}$  substituted alkyls,  $C_{3-8}$  substituted cycloalkyls, aryls substituted aryls, aralkyls,  $C_{1-6}$  heteroalkyls, substituted  $C_{1-6}$  heteroalkyls,  $C_{1-6}$  alkoxy, phenoxy and  $C_{1-6}$  heteroalkoxy; and

J is a capping group.

20 16. The prodrug of claim 1, wherein  $R_{1-2}$  are independently



wherein x is a positive integer selected so that the weight average molecular weight is at least about 2,000 Da to about 136,000 Da.

25 17. The prodrug of claim 1, wherein  $R_{1-2}$  independently have a weight average molecular weight of from about 3,000 Da to about 100,000 Da.

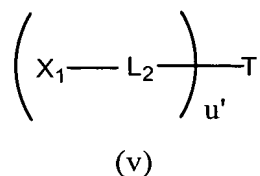
18. The prodrug of claim 1, wherein  $R_{1-2}$  independently have a weight average molecular weight of from about 5,000 Da to about 40,000 Da.

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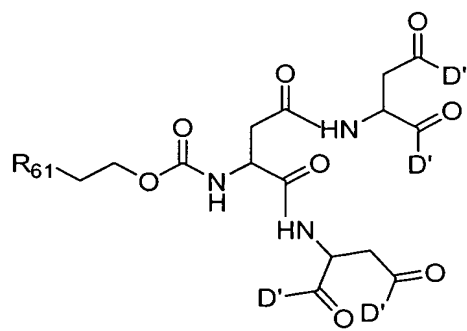
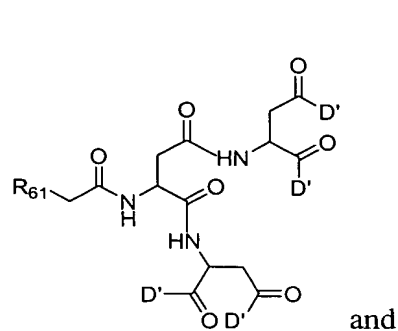
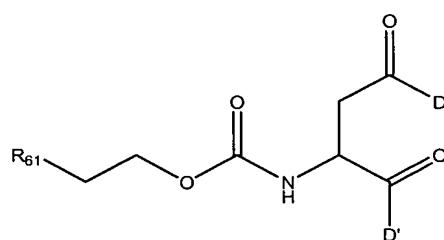
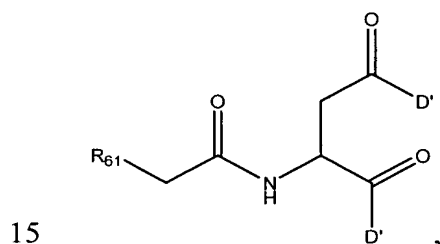
19. The prodrug of claim 8, wherein said antisense oligonucleotide is oblimersen (SEQ ID NO: 1).

5 20. An oligonucleotide prodrug of the formula: /



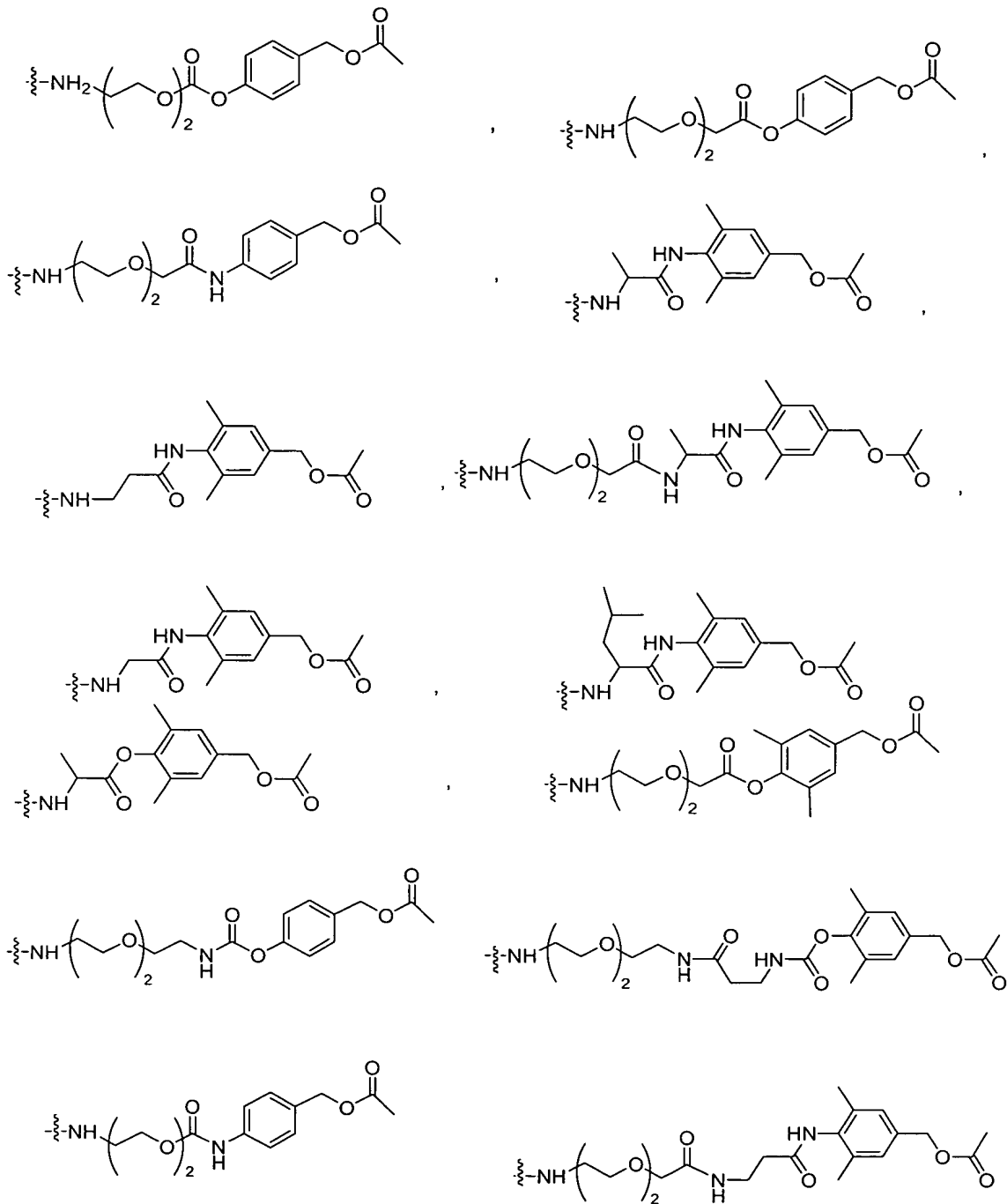
wherein:

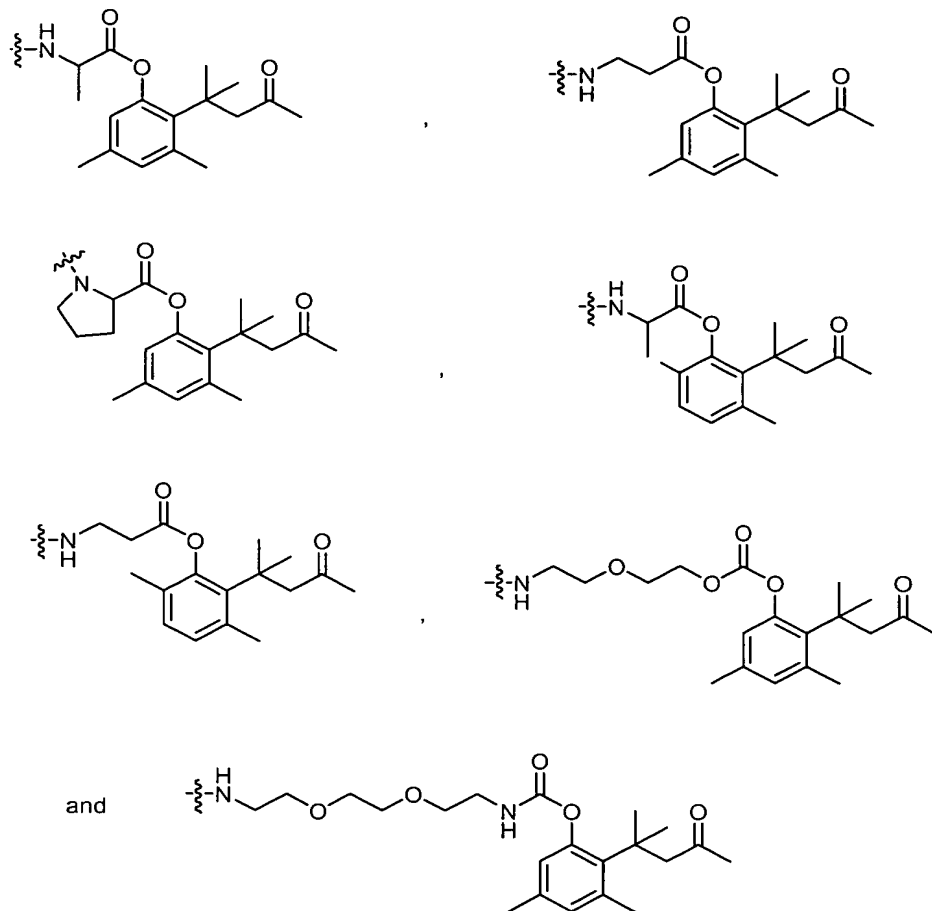
- 10  $L_2$  is a spacing group;  
 $X_1$  is a nucleotide or an oligonucleotide residue;  
 $u'$  is a positive integer; and  
 $T$  is a member of the group consisting of:



wherein:

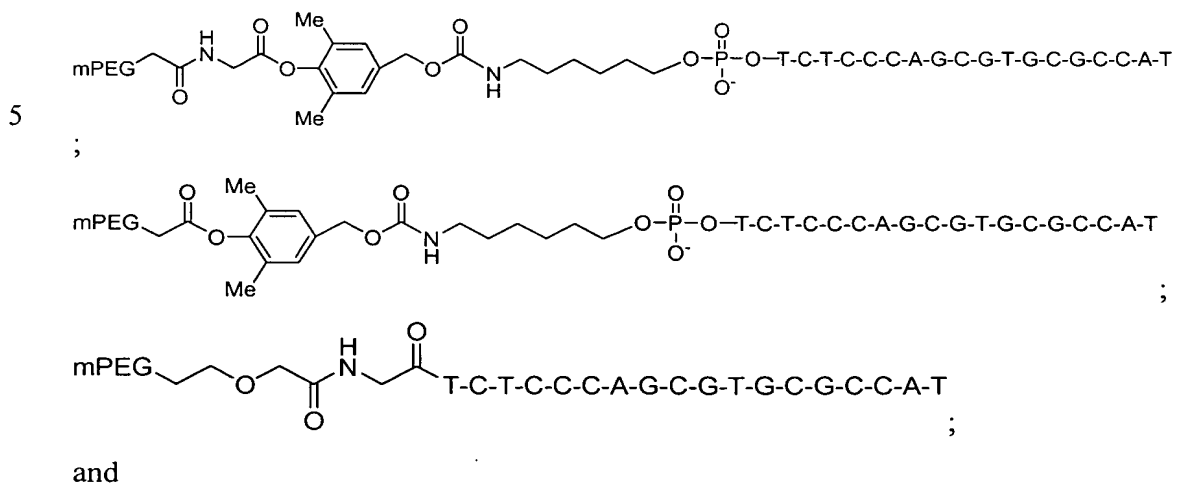
- 20  $D'$  is one of

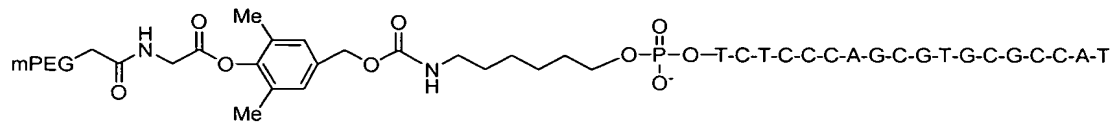




and wherein R<sub>61</sub> is a polymer residue.

21. A compound of claim 1 selected from the group consisting of:





all of which comprise an oligonucleotide of SEQ ID NO: 1.

22. A method of making a prodrug comprising:  
 5 reacting a compound of the formula:  
 $R_2-L_4$ -leaving group  
 with a compound of the formula:  
 $H-L_3-X_1$   
 under conditions sufficient to form a prodrug of the formula  
 10  $R_2-L_4-L_3-X_1$  ,  
 wherein:  
 $R_2$  is a polymer residue;  
 $L_4$  is a releasable linking moiety;  
 $L_3$  is a spacing group;  
 15  $X_1$  is a nucleotide or an oligonucleotide residue.
23. A method of treating a mammal, comprising administering to a mammal in need of such treatment an effective amount of a compound of claim 1.
- 20 24. The method of claim 23, wherein the mammal is being treated for cancer.
25. The method of claim 23, wherein  $X_1$  is an antisense oligonucleotide.
26. The method of claim 23 wherein the mammal is also treated with a second  
 25 anticancer agent that is administered simultaneously or sequentially with the oligonucleotide prodrug.